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PENSOFT

The Largetooth Sawfish, *Pristis pristis* (Linnaeus, 1758), is not extirpated from Peru: new records from Tumbes

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Abstract
The Largetooth Sawfish, *Pristis pristis*, was for a long time considered extirpated from Peru. However, here we report the capture of 2 individuals from the north coast of Peru, indicating that this species is still extant in Peruvian waters. Both individuals were adult-sized and their encounters occurred during the austral summer, which could indicate a seasonal presence in those waters. Gillnets are still a major threat for the species as both specimens were incidentally captured with this gear. Our finding highlights the need for continuous research, awareness, and legal protection of this species.

Key words
Tropical Eastern Pacific; bycatch; Pristidae; northern Peru; critically endangered species.

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Introduction

All extant sawfishes belong to the family Pristidae, which includes the genera *Anoxypristis* White & Moy-Thomas, 1941 and *Pristis* Linck, 1790 (Compagno and Cook 1995). The genus *Anoxypristis* only has 1 species: the Knifetooth Sawfish, *Anoxypristis cuspidata* (Latham, 1794); the genus *Pristis* includes 4 species: Largetooth Sawfish, *Pristis pristis* (Linnaeus, 1758); Smalltooth Sawfish, *Pristis pectinata* Latham, 1794; Dwarf Sawfish, *Pristis clavata* Garman, 1906); and Green Sawfish, *Pristis zijsron* Bleeker, 1851 (Faria et al. 2013).

Sawfishes live in shallow coastal waters usually at depths up to 20 m but as deep as 122 m (Harrison and Dulvy 2014). They can tolerate wide ranges of salinity and thus can be found in continental waters and estuaries. For example, they can swim far up into large rivers and have been found in lakes in South America, Africa, and Southeast Asia (Harrison and Dulvy 2014).

Pristis pristis is morphologically characterized by the first dorsal fin located in front of the origin of the pelvic fins, the presence, in all stages of growth, of the lower lobe of the caudal fin, and by having a shorter and wider rostrum than the other species of *Pristis* (Faria et al. 2013). Recent studies have shown that *P. perotteti* from the Atlantic Ocean and *P. microdon* from the western Indo-Pacific Ocean are synonyms of *P. pristis*. This euro-haline species, as currently defined, has a circumtropical geographic distribution with 4 genetically differentiated populations: eastern Pacific, western Atlantic, eastern Atlantic, and western Indo-Pacific Ocean (Faria et al. 2013).

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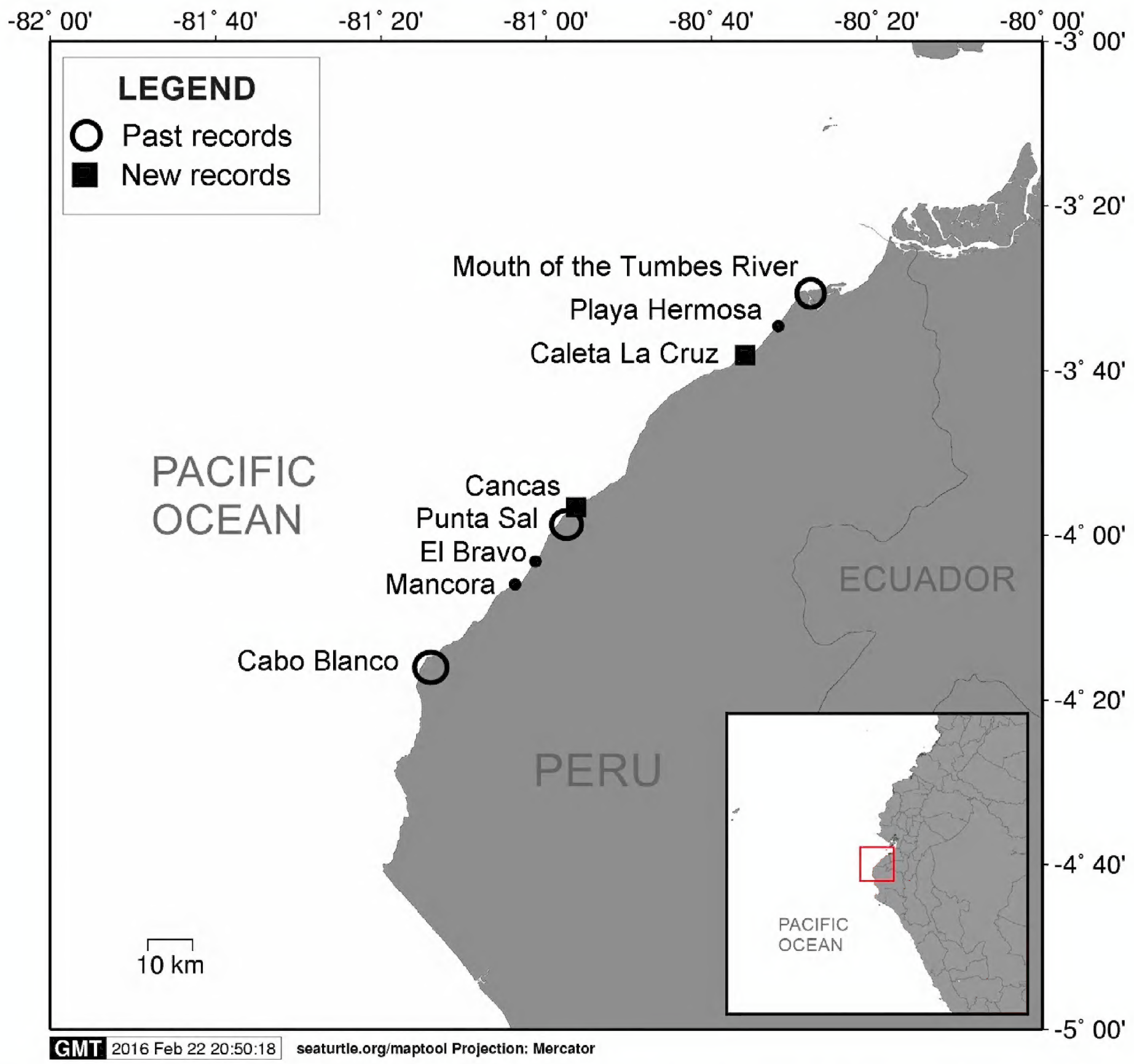

Figure 1. Map showing the locations of *Pristis pristis* recorded in Peru. Circles are previous reports of landings: mouth of the Tumbes River (Chirichigno and Cornejo 2001), Punta Sal and Cabo Blanco (McDavitt pers. comm. 2016). Squares show new landing reports: Caleta La Cruz (2014) and Cancas (2015), both in the Department of Tumbes. Map created using Maptool (Seaturtle.org 2002).

Apparently, populations of *P. pristis* have been reduced considerably from their former abundances throughout their range (Carlson et al. 2013a). According to Carlson et al. (2013a), the eastern Pacific population was formerly distributed from the Gulf of Mexico to Peru, but until 2013 only a few records existed from the Pacific coast of Nicaragua, Panama and Colombia. Therefore, Carlson et al. (2013a) argued that there had been a considerable population decline based on the retraction of the extent of occurrence of ≥ 80% over a 3-generation period. A major threat to *P. pristis* in the eastern Pacific is the decline of mangrove habitats that are utilized as nurseries, for reproduction, and feeding grounds. Other pervasive threats are longline fisheries for sharks and coastal gillnets (Carlson et al. 2013a). Consequently, the International Union for Conservation of Nature listed this species and all other sawfish species as Critically Endangered (Kyne et al. 2013). *Pristis pristis* is also included in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, as well as in Appendix 1 of the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

In Peru, occurrence data on sawfishes are relatively scarce. Until 1920, *P. pristis* was not reported in Peru, but Nichols and Murphy (1922) mentioned that fishermen already knew of it there. Chirichigno and Cornejo (2001) listed the genus *Pristis* from Peruvian waters and reported 2 species: *P. microdon* and *Pristis pectinatus* (a synonymous of *P. pectinata*). Chirichigno and Cornejo (2001) mentioned that both of these species occur in Tumbes, northern Peru; however, the report of *P. pectinatus* by Chirichigno and Cornejo (2001) was likely a misidentification of *P. pristis*, because we now know that *P. pectinata* only occurs in the Atlantic Ocean (Carlson et al. 2013b). In addition, there is undated photographic evidence showing sawfish specimens captured in Cabo Blanco and Punta Sal (Fig. 1) (Dr Matthew McDavitt pers. comm.). The most recent reports for *Pristis* species

in Peru come from information collected by researchers from the Instituto del Mar del Peru between 1996 and 2005 in the Tumbes Region (Llanos et al. 2010), but these reports are without specific information. However, an author of this report (Carlos Inga, pers. comm.) mentioned that sawfish remains were observed only up to the 1990s.

Nonetheless, until a decade ago the international scientific community thought that sawfishes did not occur in Peru (Compagno and Cook 1995, Compagno and Cook 2005). Following Faria et al. (2013), who included *P. pristis* from Peru based on previous works listing the species in Peruvian waters, subsequent scientific and technical publications also listed this species from Peru but without more precise distributional data and cited it as a historical distribution given the absence of confirmed records for more than 10 years. As a result, many researchers believed that the species had been extirpated from Peru (Carlson et al. 2013a, Dulvy et al. 2014, Harrison and Dulvy 2014).

According to fishermen from Cancas and Caleta La Cruz (Fig. 1), sawfishes used to be abundant along the north coast of Peru, but due to overfishing, they have now almost disappeared. Overfishing was driven by the high valued in Peru of sawfish teeth using in cockfighting as artificial spurs fitted to the birds' feet as a competitive advantage during fights (McDavitt 2014). In addition, sawfishes are not protected by the Peruvian legislation, so the capture and commercialization of this species is not illegal.

The objective of this study was to update the presence of *P. pristis* in Peru by reporting 2 recent records.

Methods

The area of interest is located along the coast of the department of Tumbes (Fig. 1), in the Guayaquil ecoregion of the Tropical East Pacific Marine Province (Spalding et al. 2007). The coastline of Tumbes includes 2 mangrove systems that are fed by the waters of the Tumbes and Zarumilla rivers (Angulo 2014).

On 22 January 2014, 1 specimen of *P. pristis* was incidentally captured in our nets during commercial fishing (by Wilmer Gonzales Cherres) and taken to the landing site at La Cruz, Tumbes (Fig. 1, Table 1). The sawfish was caught at dawn with a gillnet off Playa Hermosa. It was later butchered and its teeth were sold (Table 1). This specimen measured approximately 350 cm in total length (TL), the rostrum 100 cm, and the body without rostrum weighed 146 kg (Fig. 2). The specimen was a gravid female, containing yellow and spherical eggs similar to those of the Pacific Angel Shark, *Squatina californica* Ayres, 1859.

On 14 February 2015 (9:00 h), we received a call from a fishermen informing us that a sawfish was being brought alive to the Cancas dock in the district of Canoas de Punta Sal, Tumbes (Fig. 1, Table 1). The first author moved to the site and at 11:00 h the boat arrived with the specimen. It measured approximately 6 m TL, but the sex could not be determined (Fig. 3). The fish was incidentally caught by the boat during a gillnet fishing trip in front of El Bravo beach (Fig. 1). Once at the dock, fishermen Richard Pingo Antón, Luis Pingo Antón, Baltazar Fiestas Querevalu, and Tomas Pingo Chiroque called the authorities to decide what to do with the sawfish since they were unfamiliar with the regulation on its capture, but they knew that it was a rare find. They decided to release the individual, which was carried out in the presence of the Director of the Regional Directorate of Production of Tumbes (DIREPRO Tumbes), a representative of the General Directorate of Coast Guard (DICAPI), and A. Mendoza, a representative of our nonprofit organization ecOceánica, all who signed the Act of Liberation drafted by DIREPRO Tumbes. The individual was released at 12:40 h on the same day.

Results

Both specimens were identified as *P. pristis* (Figs. 2, 3) based on the following combination of distinctive characters: origin of the first dorsal fin anterior to the pelvic fin origin and presence of a lower caudal fin lobe (Faria et al. 2014).The specific identification of the specimens also was confirmed using photographs by the sawfish specialist Dr Peter Kyne, from Charles Darwin University.

Discussion

In Peru, the last year that sawfishes were observed was 1999 (Carlos Inga pers. comm.). Since then, a couple of publications reported the presence of sawfishes in Peru based on Chirichigno and Cornejo (2001). The National Action Plan for the Conservation and Management of Sharks, Rays and Related Species in Peru (PRODUCE 2014) mentions 2 species of Pristidae but without

Figure 2. Sawfish landed dead at La Cruz, Tumbes, on 22 January 2014.

Table 1. New records of *Pristis pristis* in Peru including capture data and the fate of the individuals.

Date	Landing site	Latitude	Longitude	Size TL cm	Sex	Fate
January 22, 2014	La Cruz, Tumbes	–3.6362	–80.5996	350	female	Dead, teeth sold
February 14, 2015	Cancas, Tumbes	–3.9445	–80.9400	600	unknown	Liberated alive

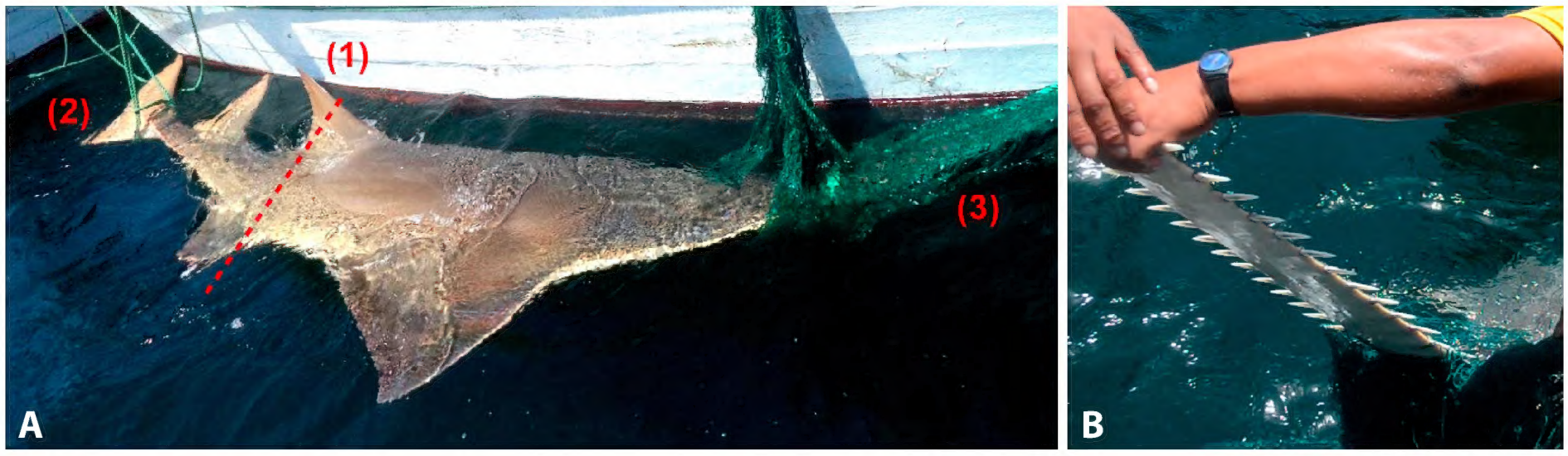

Figure 3. Sawfish captured on 14 February 2015, taken alive to Cancas, Tumbes and later released. **A.** Entire specimen showing (1) dorsal fin anterior to the origin of the pelvic fins, (2) the caudal fin, and (3) the rostrum. **B.** Another view of the rostrum.

specifying them. The other publication is a revised list of Chondrichthyans in Peru (Cornejo et al. 2015), which included *P. pristis* and *P. pectinata*. Given that the inclusion of this species in PRODUCE (2014) and Cornejo et al. (2015) are the result of literature reviews and are not based on field surveys, the documentation here of 2 new specimens provide the first empirical records of *P. pristis* in Peru since 1999.

These records demonstrate that *P. pristis* is not extirpated from Peru, and they highlight the need to identify and protect critical habitats that could contribute to sawfish conservation. There is additional anecdotal information. On 2 March 2017, a new specimen was captured in a gillnet and landed dead in Mancora (J. Guerrero Chinchay, Mancora Dock Manager, pers. comm). The 3 reports of *P. pristis* are from the same area where Chirichigno and Cornejo (2001) had earlier reported it (Fig. 1). The spatial distribution of this species in Peru would seem to extend from the Ecuadorian border to Cabo Blanco (Fig. 1).

The capture of a specimen of *P. pristis* in the Pacific waters of southern Ecuador was also reported in July 2014. The individual (506 cm TL) was landed in the port of Santa Rosa de Salinas (Universidad Laica Eloy Alfaro de Manabi 2014). This record shows that this species is not extirpated from Ecuador either, and would suggest that there is still a small extant population between southern Ecuador and northern Peru, an area where river mouths form mangrove estuaries. These data, coupled with previous reports from Nicaragua, Panama and Colombia (Carlson et al. 2013a) give support to the premise that the distribution of this species is continuous from northern Peru to Nicaragua.

The size at sexual maturity of *P. pristis* is 300 cm for females and 280–300 cm for males (Dulvy et al. 2014). Therefore, the 2 observations in Peru, and 1 in Ecuador, suggest that this part of the Eastern Pacific, adjacent to mangroves, is used by adults and reproductively active females. Moreover, it is possible that the better-preserved mangrove habitats of northern Peru could be preferred by sawfish in the southeast Pacific. On the other hand, the seasonality of the 3 encounters in Peru (late January to early March) may imply that the presence of this species in Peru represents a seasonal migration from its core area in Central America as postulated by Kyne et al. (2014). However, the observation in July of the individual in Ecuador is not in agreement with the seasonal migration hypothesis. In this regard, more research is needed to understand the habitat use and phenology of this species.

Gillnets are a major threat to the survival of sawfishes as all 3 individuals recorded recently in Peru were captured using this gear. As we have observed in the field, many fishers in northern Peru set their nets at night and check them in the morning, leaving them long periods unattended. This practice can have deleterious collateral impacts as they capture non-target species that will likely drown, be depredated, or suffer post-release mortality from stress.

Now that *P. pristis* is conclusively known not to be locally extinct in Peru, there is a need for further research on this species, to put the sawfish on the agenda of the Peruvian government, to promote their conservation through environmental education, and to seek national legislation to give the species full legal protection.

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Authors' Contributions

AM, WGC and RM collected the data, AM and SK wrote the text.

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